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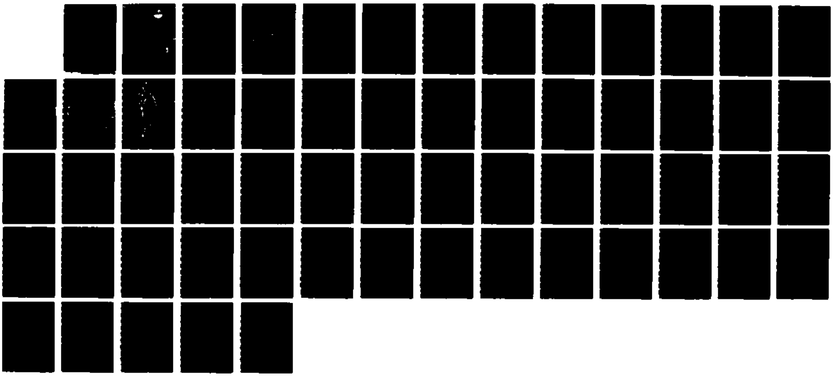

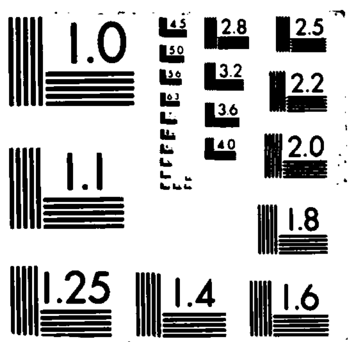
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USAFOEHL REPORT

87-062EQ0159EEF

FOR HEALTH & ENVIRONMENT

WASTEWATER CHARACTERIZATION SURVEY, PLATTSBURGH AFB NY

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May 1987

Final Report

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USAF Occupational and Environmental Health Laboratory
Human Systems Division (AFSC)
Brooks Air Force Base, Texas 78235-5501

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This report has been reviewed and is approved for publication.

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The USAFOEHL conducted a survey characterizing the wastewater in the Plattsburgh AFB sanitary and storm sewers. The scope of the survey included characterizing the major sanitary, storm, and surface water discharges from the base and determining if applicable discharge standards are being violated. A total of 31 sampling sites were evaluated including 12 sanitary, 13 surface, and 6 storm water sources. Priority pollutants were found in samples from the sanitary and storm sewers and in the streams leaving the base. Recommendations were: (1) Combustible gas detection systems should be installed in lift stations. (2) A comprehensive hazardous waste survey should be conducted to identify the source of the contaminants. (3) Respirators should be worn by personnel entering the wet well of lift stations, Building 2291. (4) Alternates for achieving better oil/water separation should be investigated. (5) The possibility of cross-connections between the sanitary and storm systems should be investigated. (6) Oil/water separators discharge should be determined and should be connected to the sanitary sewer system. (7) Streams should be monitored for ammonia to avoid aquatic (OVER)

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toxicity problems. (8) The BOD/COD ration should be determined by monitoring these parameters in the stream flowing through Copeland Oil property. (9) Additional analysis should be conducte on the seepage from the marina beach area. (10) A hazardous material training program should b instituted.

(Keywords:

ACKNOWLEDGEMENTS

The authors would like to express their appreciation for the technical expertise and hard work provided by the other members of our survey team, SSgt Mary Fields, Sgt Tammy Johnson, and SrAs Robert P. Davis and Ross Simmons, without whose valuable assistance this survey could never have been accomplished. We also acknowledge the help and support provided by the personnel from the Bioenvironmental and Civil Engineering Sections at Plattsburgh AFB during the performance of this survey.

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CONTENTS

ILLUSTRATIONS

I. INTRODUCTION

In a letter dated 15 Nov 1986, the USAF Hospital Plattsburgh, Bioenvironmental Engineering section (SGPB) requested the USAF Occupational and Environmental Health Laboratory, Environmental Quality Branch (USAFOEHL/ECQ) conduct a survey to identify wastewater contaminants in the Plattsburgh AFB sanitary sewer and storm sewer systems.

The scope of this survey included characterizing the major sanitary, storm, and surface water discharges from the base and determining whether applicable standards are being violated. One of the purposes of this survey was to determine if Plattsburgh AFB is a source of contaminants whose concentrations are above allowable levels, and if so, to identify the general areas of emanation. The other purpose was to determine if runoff from the base is polluting the streams which drain the base area, especially the stream running through the community of Cliffhaven.

The survey was conducted by Lt Col Robert D. Binovi, Mr Arturo Riojas, 2Lt Michael Spakowicz, SSgt Mary Fields, Sgt Tammy W. Johnson and A1Cs Robert P. Davis and Ross W. Simmons, USAFOEHL/ECQ, from 16 July to 28 July 1986.

II. BACKGROUND

A. Introduction

Plattsburgh AFB, the home of the 380th Bombardment Wing, is located in northeastern New York State on the shore of Lake Champlain. Part of the base is located within the city limits of the City of Plattsburgh in Clinton County. The rest is located south of the city limits. The base population at the time of the survey included 4199 military personnel, 491 civilian personnel and 5550 dependents. The average high and low temperatures for the survey period were 78.8 and 69.7 degrees F. A total of 0.81 inches of rain fell on 26 July 1986, the only measurable precipitation recorded during the survey period.

Local Law No. 1 of 1984, issued by the Common Council of the City of Plattsburgh, New York, defines a significant industrial user as any industrial user of the City's wastewater disposal system who is found by the City, State or the U.S. Environmental Protection Agency (EPA) to have a significant impact, either singly or in combination with other contributing industries, on the wastewater treatment system, the quality of sludge, the system's effluent quality, or air emissions generated by the system.[1] Since the base discharges some of the compounds that have discharge limits or action levels into the Plattsburgh sanitary sewer system, the base does affect the system's effluent quality and is, therefore, a significant industrial user.

B. Description of the Water Conveyance System

1. Sanitary Sewer System

Sewage from Plattsburgh AFB is treated by the City of Plattsburgh Publicly Owned Treatment Works (POTW). For the past several years, the Plattsburgh POTW has maintained that Plattsburgh AFB is at least partially responsible for contaminants exceeding the effluent limits specified in their State Pollutant Discharge Elimination System (SPDES) discharge permit.

Sewage leaves the base from three sub-mains entering the city main at three points: two along Rt. 9, and another east of the officer's club. The corresponding manhole designations are "A", "C", and "B", respectively. All the sewage from the new base and the sewage from the southernmost housing area on the old base flows past Manhole "A". This stream includes most of the industrial wastewater generated on base, mixed with domestic sewage. Sewage from most of the housing area on the northwest part of the old base flows past Manhole "B". A small amount of domestic sewage mixed with wastewater from nonresidential buildings on the old base (e.g., entomology, hobby shop, officer's club) flows past Manhole "C". Samples from sites 15, 19, and 20 are representative of wastewater flows past Manholes "A", "B", and "C", respectively.

2. Storm Drainage System

Four distinct drainage areas were identified at Plattsburgh AFB. Storm water from the northeast side of the runway drains by conduit and drainage ditches into the golf course ponds which discharge into a stream, flowing off base to Lake Champlain through the Cliffhaven subdivision. Storm water from the old part of the base east of Rt. 9 drains by conduit and drainage ditches under the Delaware and Hudson Railroad tracks into Lake Champlain. Most of the southern end of the runway drains into the Salmon River. A small portion of the northern end of the runway storm system empties into the Saranac River.

For the purposes of this report, the storm drainage system is subdivided into two systems since storm drainage collected from housing and industrial areas discharges into storm sewers as well as streams and ponds. The collection system, comprised of paved ditches and culverts, is designated as the storm drainage system, while the unpaved ditches, streams and ponds leading to off-base discharge points are designated as surface water bodies.

C. Plattsburgh AFB Wastewater Discharge Limitations

1. Sewage

At the present time, Plattsburgh AFB must comply with the general discharge prohibitions and limitations listed in Local Law No. 1 of 1984, governing all users of the POTW. The general discharge guidelines (Sec. 5-1) prohibit the discharge of explosive substances, solid or viscous substances, wastewater with a pH less than 5.5, toxic pollutants which could interfere with the wastewater treatment process, noxious or malodorous liquids, gases or solids, wastewater with objectionable color which cannot be removed in the treatment process, wastewater having a temperature which will inhibit biological activity in the POTW. Also prohibited are radioactive wastes, any substance which will cause the POTW to violate its New York SPDES permit or the receiving water quality standards, and wastewater which is hazardous to human life or creates a public nuisance.

Furthermore, the more stringent of applicable Federal Pretreatment Standards and New York State limits on discharges apply. The substances, sampling requirements, and discharge limits for Plattsburgh AFB which are included in the SPDES permit are shown in Table 1.

TABLE 1

CONTAMINANT DISCHARGE LIMITS AND SAMPLING REQUIREMENTS

EFFLUENT PARAMETERS	DISCHARGE LIMITS	MEASUREMENT FREQUENCY	SAMPLE TYPE
Benzidine	0.6 lbs/day	1/3 months	24-hour composite
Bis (2-ethylhexyl) Phthalate	1.4 lbs/day	1/month	24-hour composite
Cadmium	1.4 lbs/day	1/month	24-hour composite
Lead	1.4 lbs/day	1/month	24-hour composite
Mercury	0.13 lbs/day	1/3 months	24-hour composite
Pentaphenol	1.4 lbs/day	1/month	24-hour composite
Phenols	5.4 lbs/day	1/month	24-hour composite
Selenium	0.8 lbs/day	1/3 months	24-hour composite
Silver	1.4 lbs/day	1/month	24-hour composite
Zinc	32.0 lbs/day	1/month	24-hour composite

In addition, there are substances which "have been reported present in the discharge but at levels that currently do not require water quality or technology based limits. Action levels have been established which if exceeded will result in reconsideration of Water Quality and Technology based limits."[1] These substances and sampling requirements are shown in Table 2.

TABLE 2

CONTAMINANT ACTION LEVELS AND SAMPLING REQUIREMENTS

EFFLUENT PARAMETER	ACTION LEVEL	MEASUREMENT FREQUENCY	SAMPLE TYPE
Methylene Chloride	1.5 lbs/day	1/year	Grab
Benzene	1.5 lbs/day	1/year	Grab
Tetrachloroethylene	1.5 lbs/day	1/year	Grab
Copper	4.0 lbs/day	1/6 months	24-hour composite
Nickel	2.0 lbs/day	1/6 months	24-hour composite
Chromium	1.5 lbs/day	1/6 months	24-hour composite
Cyanide (free)	1.5 lbs/day	1/6 months	24-hour composite
Arsenic	1.5 lbs/day	1/year	24-hour composite
3,3 Dichlorobenzidine	1.5 lbs/day	1/year	24-hour composite
Di-N-Butyl Phthalate	1.5 lbs/day	1/year	24-hour composite
Trichloroethylene	1.5 lbs/day	1/6 months	24-hour composite
Toluene	1.5 lbs/day	1/6 months	Grab
Naphthalene	1.5 lbs/day	1/year	24-hour composite

2. Storm Drainage

a. There is no SPDES discharge permit in effect governing the discharge of storm water from the base. However, the bodies of water into which base storm water flows are classified, with each class having a set of quality standards which must be maintained. The base discharges into part of Lake Champlain that is classified as a Class B water body.[2] The Saranac River is a Class C river and the Salmon River is a Class C(T) river.

b. The Lake Champlain discharges (Class B) must meet the following standards:

1. Monthly median coliform concentration less than 24,000 organisms/100 ml

2. pH between 6.5 and 8.5

3. Total dissolved solids concentration below 500 mg/l

4. Dissolved oxygen concentration not less than 4.0 mg/l

c. The Saranac River discharge (Class C) must meet the following standards:

1. Monthly median coliform concentration less than 10,000 organisms/100 ml

2. pH between 6.5 and 8.5

3. Total dissolved solids concentration below 500 mg/l

4. Dissolved oxygen concentration not less than 4.0 mg/l

d. The Salmon River (Class C(T)) must meet the following standards:

1. Monthly median coliform concentration less than 10,000 organisms/100 ml

2. pH between 6.5 and 8.5

3. Total dissolved solids concentration below 500 mg/l

4. Dissolved oxygen concentration not less than 6.0 mg/l

e. Although limits on iron and ammonia are not imposed in applicable ordinances, the United States Environmental Protection Agency (EPA) recommends criteria for these materials in freshwater, based on their toxicity to aquatic life.[3] Concentrations in the receiving water near the points of discharge may approach levels found in the water being discharged. Therefore, information on iron and ammonia is included.

f. The toxicity of iron and ammonia varies with many factors, including water pH, temperature, and aquatic species. Limits on iron are usually imposed for esthetic reasons; however, high iron concentrations are toxic to certain aquatic species. The EPA recommends that an iron concentration of 1.0 mg/l not be exceeded in freshwater bodies. The ammonia criterion is more closely tied to temperature and pH because it relates to the equilibrium between free ammonia, NH_3, and the ammonium ion, NH_4^+. Higher temperatures and pH values result in higher percentages of un-ionized ammonia in solution. The toxic chemical species is free ammonia, and lethal concentrations range from 0.2 to 2.0 mg NH_3/l for trout and carp, respectively. At a pH of 8.0, the corresponding concentrations of total ammonia (NH_3 & NH_4^+) are 16.7 to 167 mg/l at 5°C and 3.7 to 37 mg/l at 25°C.

III. PROCEDURES

A. Sampling Site Locations

The types and locations of the sampling sites, referred to by number in the following text, are given in Table 3. The abbreviation "SSN" stands for sampling site number. Figures 1 and 2 show the locations of the sampling sites on the new base and the south half of the old base, and the locations on the north half of the old base, respectively.

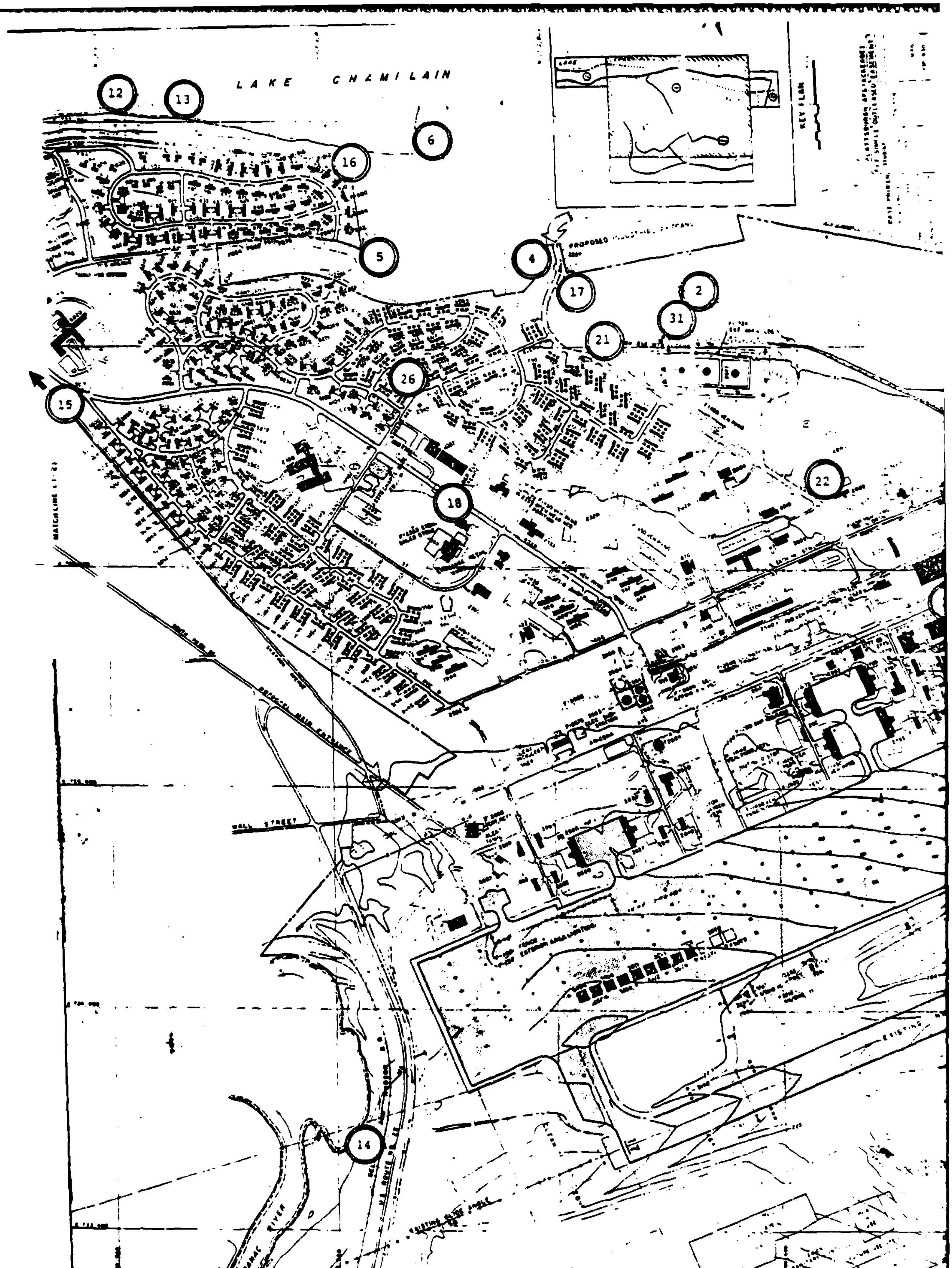
B. Sampling Frequency

Five days of 24-hour equiproportional samples composited hourly were taken at Sites 3, 15, 16, 17, 18 and 19. A one-day 24-hour sample composited hourly was taken at Sites 1, 2, 4, 5, 6, 8, 9, 10, 12, 13, 14 and 20. Also, a one-day 24-hour sample composited hourly was planned for Sites 7 and 11, but there was no flow at those sites during the sampling period. Composite samples were collected with Isco Model 2100 Automatic Wastewater Composite Samplers. Grab samples were taken at Sites 21, 22, 23, 24, 25, 26, 27, 28, 29, 30 and 31. The sampling schedule is summarized in Table 4.

C. Sample Analyses

The individual sampling sites and corresponding analyses are listed in Appendix A. A sample of water from the marina beach was analyzed for fecal coliform bacteria to aid Plattsburgh AFB personnel with a minor problem that arose during the survey. The sample collection and analysis were not part of the formal survey, but the results are included in the Results and Discussion section, later in this report.

The method of analysis and the method of sample preservation prescribed for each parameter are listed in Table 5. Contract laboratory error resulted in the substitution of EPA Method 602 for EPA Method 604. Therefore, chlorotoluene analysis results were reported rather than a breakdown of the various phenolic compounds found in wastewater samples.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SARANAC RIVER
KEY PLAN

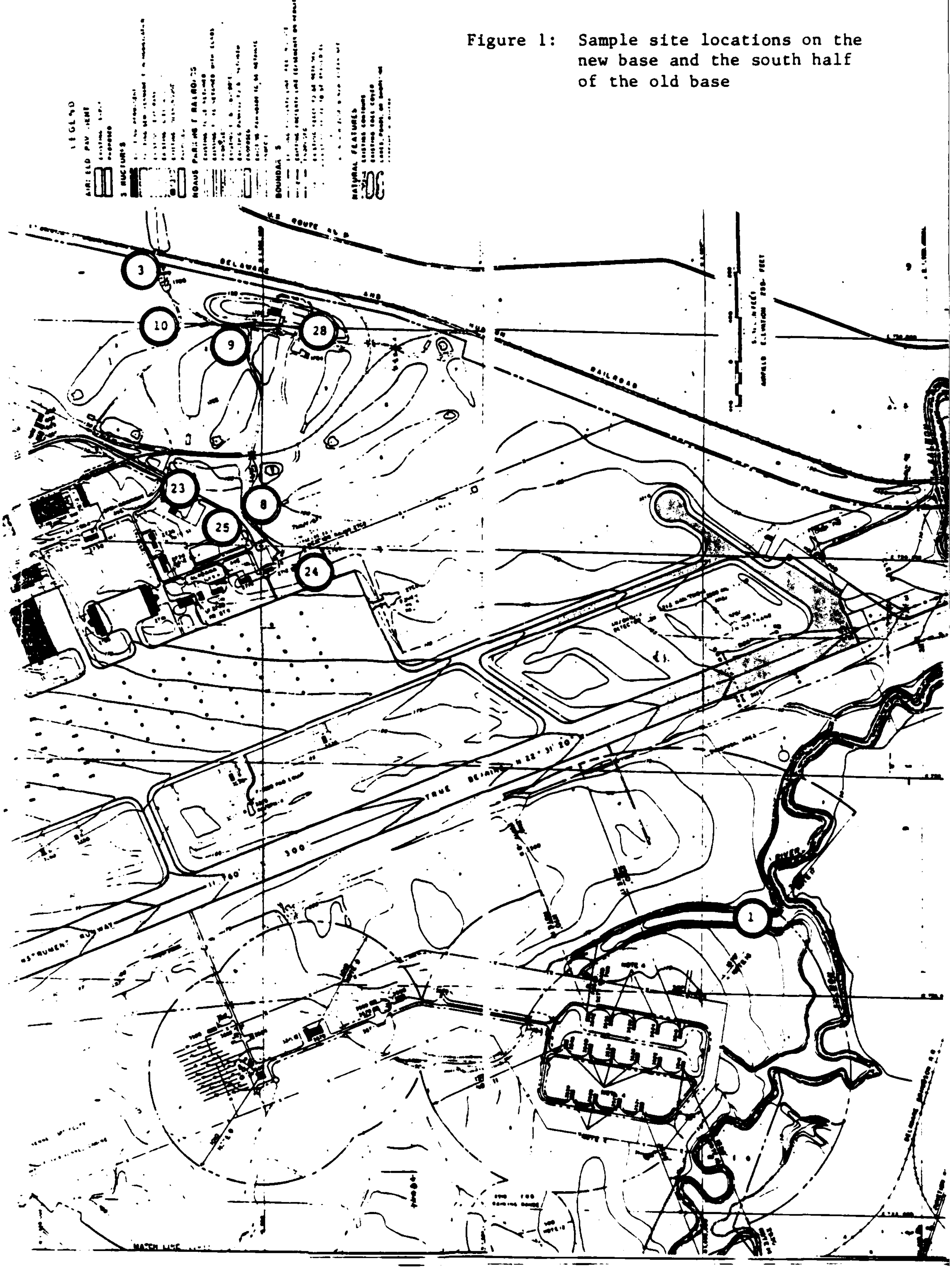

Figure 1: Sample site locations on the new base and the south half of the old base

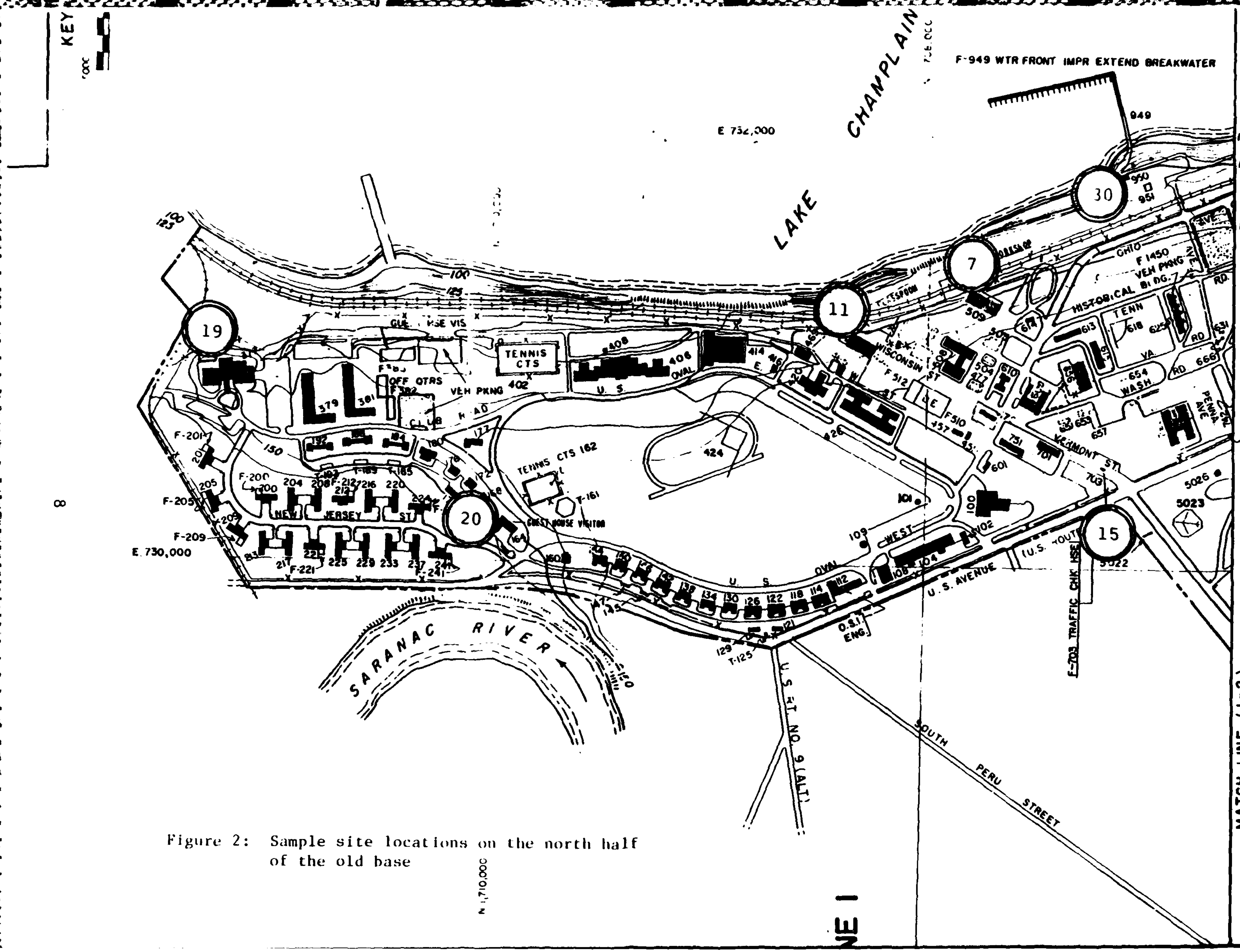

Figure 2: Sample site locations on the north half of the old base

TABLE 3

SAMPLING SITE LOCATIONS AND TYPES

Site #	Location	Type
1	Base SSN 0159-NS-004, washed out bridge, SW of base	stream
2	Base SSN 0159-NS-008, ski trail, E. bulk storage area	stream
3	Base SSN 0159-NS-003, NE of golf course clubhouse	stream
4	Near the intersection of Connecticut Rd. and US 9	stream
5	Drop inlet C-35, near SW corner Copeland Oil	storm
6	Downstream from the Copeland Oil Co. property	stream
7	Manhole #30, NE corner Building 509	storm
8	Base SSN 0159-NS-002, Pond outlet, Idaho Ave. & golf course	pond
9	Confluence downstream from site 8	stream
10	Base SSN 0159-NS-005, Confluence east of tee #3	stream
11	Drop inlet 62, NE corner Building 492	storm
12	Near curb inlet F-33, Ohio Ave. E.	stream
13	Curb inlet F-32, Nevada Oval E. & New Hampshire	storm
14	Ditch draining N end of the runway, W. Arizona and US 22	stream
15	Manhole H-1, New York Road & US 9	sanitary
16	Building 902	sanitary
17	Building 2291	sanitary
18	Manhole H-15, New York Road near Building 2338	sanitary
19	Manhole upstream of Manhole B, E of Officer's Club	sanitary
20	Manhole 145, NW corner Building 163, New Jersey St.	sanitary
21	Manhole L-5, Connecticut Road and bulk storage area access Road	sanitary
22	Manhole D-3, NE corner Building 2005, off Connecticut Road	sanitary
23	Manhole A-15, Arizona Ave. and Idaho Ave.	sanitary
24	Grate T-104, Control tower parking lot	storm
25	Curb inlet Q-6, Idaho Ave.	storm
26	Manhole 56, Kansas Ave.	sanitary
27	Manhole B-7, Arizona Ave., SE corner Building 2774	sanitary
28	Hole 7 fairway pond	pond
29	Cliffhaven beach	stream
30	Marina beach seepage area	stream
31	Manhole A-4, bulk storage area	sanitary

TABLE 4

SAMPLE TYPE AND SAMPLING FREQUENCY

SITE #	DESCRIPTION	TYPE	FREQUENCY
1	BSN 0159-NS-004	Hourly Composite	1 day/24 hr
2	BSN 0159-NS-008	Hourly Composite	1 day/24 hr
3	BSN 0159-NS-003	Hourly Composite	5 day/24 hr
4	Connecticut Rd. and US 9	Hourly Composite	1 day/24 hr
5	Drop Inlet C-35	Hourly Composite	1 day/24 hr
6	Copeland Oil Co.	Hourly Composite	1 day/24 hr
7	MH #30	None	1 day/24 hr
8	BSN 0159-NS-002	Hourly Composite	1 day/24 hr
9	Downstream from Site 8	Hourly Composite	1 day/24 hr
10	BSN 0159-NS-005	Hourly Composite	1 day/24 hr
11	Drop Inlet 62	None	1 day/24 hr
12	Near Curb Inlet F-33	Hourly Composite	1 day/24 hr
13	Curb Inlet F-32	Hourly Composite	1 day/24 hr
14	Stream, north end runway	Hourly Composite	1 day/24 hr
15	MH H-1	Hourly Composite	5 day/24 hr
16	Building 902	Hourly Composite	5 day/24 hr
17	Building 2291	Hourly Composite	5 day/24 hr
18	MH H-15	Hourly Composite	5 day/24 hr
19	MH Upstream of MH-B	Hourly Composite	5 day/24 hr
20	MH 145	Hourly Composite	1 day/24 hr
21	MH L-5	Grab	1
22	MH D-3	Grab	1
23	MH A-15	Grab	1
24	Grate T-104	Grab	1
25	Curb Inlet Q-6	Grab	1
26	MH 56	Grab	1
27	MH B-7	Grab	1
28	7th Hole Pond	Grab	1
29	Cliffhaven Beach	Grab	1
30	Marina beach seepage area	Grab	1
31	MH A-4	Grab	1

TABLE 5

ANALYSIS AND SAMPLE PRESERVATION METHODS

PARAMETER	PRESERVATION	EPA METHOD	WHERE	WHO
Biochemical Oxygen Demand (5-day)	None	405.1	on-site	USAFOEHL
Chemical Oxygen Demand	H_2SO_4	Hach Mod. 410.4	"	"
pH	None	A423	"	"
Temperature	None	170.1	"	"
Oils and Grease	H_2SO_4	413		Biospherics
Phenols	H_2SO_4	604		"
Pesticides	H_2SO_4	608		Biospherics
Volatile Hydrocarbons	H_2SO_4	624		"
Acid/Base/Neutrals	4C	625		"
Total Organic Carbon	H_2SO_4	415		"
Metals	HNO_3	200.7		"
Total Cyanide	NaOH	335		"
Nitrate-Nitrite	H_2SO_4	353		"
Ammonia	H_2SO_4	350		"
Kjeldahl Nitrogen	H_2SO_4	305		"
Total Phosphorous	H2SO4	365		"
Total Suspended Solids	4C	A209F	on-site	USAFOEHL
Microscopic Analysis	None	N/A	on-site	USAFOEHL

D. Study of Effect of pH on Emulsion

Wastewater taken from Site 27 had a very strong organic solvent odor and appeared hazy. A sample of the water was taken to the lab and the pH measured. Suspecting that organic solvents were emulsified in the wastewater due to the presence of alkaline detergents, acid was added to the sample, and the sample was observed.

IV. RESULTS AND DISCUSSION

Contaminant concentrations and physical and chemical parameter values are presented in this section to characterize the various wastewater streams sampled during the survey. Some of the concentrations reported illuminate potential problems with materials for which discharge limits or action levels exist. Others simply contribute to the identifying characteristics of the wastewater which suggest possible sources of the contaminants or possible operations and maintenance problems. This is information that could prove helpful during a hazardous waste survey.

A. Sanitary Sewer System

1. Sampling Sites: Eleven sites in the sanitary sewer system were sampled. The following is a description of the sites and significant findings at each site.

a. Site 15: The sample was taken from manhole H-1 which is near the intersection of New York Road and US 9. Manhole H-1 drains most of the new base. The following materials (and maximum concentrations) were detected: benzene (82 μg/l), toluene (14 μg/l), 1,2-dichlorobenzene (73 μg/l), 1,2,4-trichlorobenzene (18 μg/l), naphthalene (17 μg/l), bis(2-ethylhexyl)phthalate (19 μg/l), phenol (14 μg/l), 2-nitrophenol (11 μg/l). The following nonpriority pollutants (and maximum concentrations) were also detected: 4-chloroaniline (13 μg/l), 2-methylnaphthalene (14 μg/l), 4-methylphenol (100 μg/l), and chlorotoluene (9,000 μg/l). The average concentrations of iron, copper, and zinc were 1.975 mg/l, 211.5 μg/l, and 116.7 μg/l, respectively. The average concentration of oil and grease was 29.3 mg/l. The COD was 302.5 mg/l.

b. Site 16: The sample was taken from Building 902 which drains a residential area. The average concentration of oil and grease was 16.7 mg/l. The BOD was 134 mg/l and the COD, 325 mg/l.

c. Site 17: The sample was taken from Building 2291 which drains most of the area south and east of New York Avenue and North Dakota Avenue. This includes more than half of the industrial area on base and some residential areas. The following materials (and maximum concentrations) were detected: methylene chloride (12 μg/l), chloroform (12 μg/l), toluene (24 μg/l), naphthalene (38 μg/l), hexachlorobutadiene (30 μg/l), di-n-butylphthalate (31 μg/l), bis(2-ethylhexyl)phthalate (64 μg/l), and phenol (32 μg/l). The following nonpriority pollutants (and maximum concentrations) were also detected: 4-chloroaniline (24 μg/l), 2-methylnaphthalene (26 μg/l), 4-methylphenol (160 μg/l), and chlorotoluene (8.2 μg/l). The average concentrations of iron, copper, silver, and zinc were 2.0 mg/l, 153 μg/l, 13 μg/l, and 108 μg/l, respectively. The average concentration of oil and grease was 42.2 mg/l. The BOD and COD levels were 132.5 mg/l and 331.7 mg/l, respectively.

d. Site 18: The sample was taken from manhole H-15, located next to New York Road near the NE corner of Building 2338 and drains some of the industrial area of the base and the Main BX and base theater area. Methylene chloride was only detected in one of five samples collected, but the concentration was very high (100,000 μg/l). The following materials (and maximum concentrations) were also detected: chloroform (20 μg/l), benzene (200 μg/l), toluene (38 μg/l), 1,2-dichlorobenzene (150 μg/l), butylbenzylphthalate (30 μg/l), bis(2-ethylhexyl)phthalate (20 μg/l), and phenol (16 μg/l). The following nonpriority pollutants (and maximum concentrations) were detected: 4-methylphenol (92 μg/l) and chlorotoluene (8.2 μg/l). The average concentrations of iron, copper, lead, nickel, and zinc were 1.56 mg/l, 170 μg/l, 42 μg/l, 87 μg/l, and 138 μg/l, respectively. The average concentration of oil and grease was 16.1 mg/l. The average BOD and COD levels were 92.4 mg/l and 256.7 mg/l, respectively.

e. Site 19: The sample was taken from the first manhole downstream of manhole 204 which is east of the officer's club and drains part of the old base. The following materials (and maximum concentrations) were detected: toluene (6.1 μg/l), diethyl phthalate (26 μg/l), di-n-butylphthalate (24 μg/l), bis(2-ethylhexyl)phthalate (19 μg/l), phenol (51 μg/l), and 2-nitrophenol (30 μg/l). The following nonpriority pollutants (and maximum concentrations) were also detected: trichlorofluoromethane (55 μg/l), 4-methylphenol (216 μg/l), and chlorotoluene (20 μg/l). The average concentrations of iron, copper, silver, zinc, and cyanide were 1.6 mg/l, 149.8 μg/l, 12 μg/l, 127.5 μg/l, and 0.02 mg/l, respectively. The average concentration of oil and grease was 33.8 mg/l. The BOD and COD levels were 202.5 mg/l and 410 mg/l, respectively.

f. Site 20: The sample was taken from manhole 145 which is near the NW corner of Building 163 about 40 feet from New Jersey Street and drains a residential area. The concentration of oil and grease was 18.8 mg/l. The BOD and COD levels were 21.2 mg/l and 200 mg/l, respectively.

g. Site 21: The sample was taken from manhole L-5, which is near the intersection of Connecticut Road and the easternmost access road to the bulk storage area and drains the area adjacent to the bulk storage area. The COD was 1960 mg/l.

h. Site 22: The sample was taken from manhole D-3, which is near the NE corner of Building 2005 off Connecticut Road and drains part of the industrial area. The COD was 275 mg/l.

i. Site 23: The sample was taken from manhole A-15, which is near the intersection of Arizona Avenue and Idaho Avenue and drains part of the industrial area. The average lead and silver concentrations found were 211 μg/l and 22 μg/l, respectively. The concentration of oil and grease was 9.9 mg/l.

j. Site 26: The sample was taken from manhole 56 off Kansas Avenue which drains the base gasoline station and a few residences. The COD was 240 mg/l.

k. Site 27: The sample was taken from manhole B-7 off Arizona Avenue near the SE corner of Building 2774. This manhole receives drainage from the "black hangar" area. The COD was 1260 mg/l.

l. Site 31: The sample was taken from manhole A-4 which drains the bulk storage area. No significant problem was detected.

2. Summary of Analyses

Batch operations commonly found on air bases result in fluctuating pollutant concentrations in wastewater streams. Mean concentrations are approximated through the use of composite samplers. However, volatile contaminants are not adequately retained in water collected by a composite sampler. Furthermore, contaminant volatilization depends on the degree of agitation of the collected water and volatility of the contaminant as measured by the Henry's Law constant. Therefore, volatile concentrations are determined by analyzing grab samples. Consequently, slugs of volatile solvents can go undetected if sampling does not coincide with solvent-laden wastewater discharge. For example, at Site 18, methylene chloride concentrations were below the detection limit on four of five grab samples collected. The fifth sample contained 100,000 μg/l, several hundred times the mean concentration allowed in the discharge to the POTW. Similarly, if the slugs are short in duration (less than one hour long), they can pass the sampling point between composite sampler cycles.

Table 6 gives a summary of maximum priority pollutant concentrations found in the sanitary sewers. Pollutants not found at any of the sites (e.g., Cr, Cd) are not listed. NS indicates the parameter analysis was not performed. ND indicates the analysis was performed, but the contaminant concentration was below the normal detection limit of the analysis. An asterisk (*) next to a value indicates that problems were experienced with the analysis of one or more samples from that site, and that the value given excludes values reported by the contract lab as <50 μg/l. The mean allowed concentrations in Table 6 are based on a mean volumetric flow rate of 0.62 mgd and the allowed discharge values listed in Tables 1 and 2. (The total volume of sewage from the base was estimated at 0.62 million gallons per day by the Plattsburgh AFB BEE.)[*] Other analysis results are recorded in Appendix B and are listed in the order of assigned sampling site number. All analyses for pesticides (EPA Method 608) showed levels below the detection limits of the 21 compounds in the scan.

TABLE 6

SUMMARY OF MAXIMUM PRIORITY POLLUTANT CONCENTRATIONS DETECTED IN THE SANITARY SEWER SYSTEM

Parameter	Mean Concentration Allowed (µg/l)	Maximum Concentration Observed (µg/l) SITE #: 15	17	18	19	23	27	31
Benzene	290	82*	ND*	200*	ND*	ND*	ND*	ND
Bis (2-ethylhexyl) Phthalate	271	19	64	20	19	NS	NS	NS
Copper	774	325	171	337	182	NS	NS	NS
Di-N-Butyl Phthalate	290	ND	31	ND	24	NS	NS	NS
Lead	271	ND	ND	42	ND	211	NS	NS
Methylene Chloride	290	ND*	12*	100K*	ND*	ND*	ND*	ND
Naphthalene	290	17	38	ND	ND	NS	NS	NS
Nickel	387	ND	ND	87	ND	NS	NS	NS
Phenols	1044	14	32	16	51	NS	NS	NS
Silver	271	ND	13	ND	12	22	NS	NS
Toluene	290	14*	24*	38*	6.1*	ND*	ND*	ND
Zinc	6188	180	150	200	160	NS	NS	NS

3. Effect of pH on Emulsion

The addition of sulfuric acid to the hazy, organic-laden wastewater sample from Site 27 resulted in the appearance of tiny "oil slicks" on the surface of the sample being tested. By lowering the pH of the solution, emulsified oil was released and allowed to rise to the surface. The optimum pH for oil/water separation was not determined, but pH values as low as 2 were used in the experiment. This indicated that lowering the pH is an effective means of breaking oil-in-water emulsions, however, neutralization of the resulting pH of the aqueous phase would be required.

B. Storm Drainage System

1. Sampling Sites: Five sites in the storm drainage system were selected for sampling. The following is a description of the sites and significant findings:

a. Site 5: The sample was taken from drop inlet C-35 which is just inside of the base boundary fence near the SW corner of the Copeland Oil Co. tank farm (the one which is west of US 9) and drains a predominantly residential area. No significant contamination was detected.

b. Site 7: An Isco was set up at manhole 30 which is near the NE corner of Building 509 and drains part of the old base. No sample was collected since no flow occurred at this site during the sampling period.

c. Site 11: An Isco was set up at drop inlet 62 which is near the NE corner of Building 492 and drains part of old base. No sample was collected since no flow occurred at this site during the sampling period.

d. Site 13: The sample was taken from curb inlet F-32 which is near the corner of Nevada Oval East and New Hampshire Street and drains a predominantly residential area and the hospital area. The BOD and COD were 11.5 mg/l and 38 mg/l, respectively.

e. Site 25: The sample was taken from curb inlet Q-6 off Idaho Avenue which drains the area along Alabama Avenue and part of Idaho Avenue. The COD was 48 mg/l. The iron concentration was 3500 µg/l, exceeding the EPA criterion for iron levels in fresh water bodies.

2. Summary of Analyses

Of the five sampling sites in the storm drainage system, Sites 7 and 11 had no flow. No storm drainage system water samples were collected for priority pollutant analysis. Downstream surface water bodies were sampled for these pollutants instead. Other analysis results are recorded in Appendix B and are listed in the order of assigned sampling site number. The pesticide analysis for Site 11 (EPA Method 608) showed levels below the detection limits of the 21 compounds in the scan.

C. Surface Water

1. Sampling Sites: Fourteen surface water sites were sampled in the formal survey. In addition, a sample from the marina beach was analyzed for fecal coliforms, and a population of 120 colonies/100 ml was found. The following is a description of the sites and significant findings at each site:

a. Site 1: The sample was taken from the stream at the washed out bridge. This stream empties into the Salmon River. This site is located in the SW section of the base, west of the runway, east of the weapons storage area and receives runoff from most of the area west of the runway. A large amount of methylene chloride was found (11,000 µg/l) at this site. The following materials (and maximum concentrations) were also detected: benzene (210 µg/l) and toluene (44 µg/l).

b. Site 2: The sample was taken from the stream where the ski trail crosses it, about 40 feet upstream of the base boundary fence. This site is located west of US 9, east of the bulk storage area and receives runoff from the bulk storage area and the area along Connecticut Road between Kansas Avenue and Idaho Avenue. A large amount of methylene chloride was found (57,000 µg/l) at this site. The following materials (and maximum concentra- tions) were also detected: benzene (190 µg/l) and toluene (40 µg/l). The BOD and COD were 12.7 mg/l and 27 mg/l, respectively.

c. Site 3: The sample was taken from the stream about 15 feet upstream of the base boundary fence. This site is located northeast of the golf course clubhouse and receives runoff from most of the parking ramp adjacent to the runway and most of the industrial area of the base. Methylene chloride was detected on two of the four days it was tested for. The average concentration was 7150 µg/l. The following materials (and maximum concentrations) were detected: benzene (140 µg/l), toluene (28 µg/l), 1,2,4-trichlorobenzene (14 µg/l), di-n-butylphthalate (27 µg/l), bis(2-ethylhexyl)phthalate (13 µg/l), and chlorotoluene (1.9 µg/l). Chlorotoluene is not a priority pollutant. Average concentrations of iron, chromium, and zinc were 1.88 mg/l, 50 µg/l, and 196.7 µg/l, respectively. The iron concentration exceeded the EPA criterion for fresh water bodies. The concentration of oil and grease on one day was 30 mg/l. However, the concentrations on the other four days were insignificant. The pH was 7.7 and the average concentration of ammonia was 5.6 mg/l. This exceeds the EPA's criterion at a pH of 8 and a temperature of 25°C. The BOD and COD were 14.8 mg/l and 38 mg/l, respectively.

d. Site 4: The sample taken from the stream at the culvert outfall which is just outside the base boundary fence near the intersection of Connecticut Road and US 9 and drains a predominantly residential area. No significant contamination was detected.

e. Site 6: The sample was taken from the stream as it leaves the culvert which passes underneath the railroad tracks downstream of the Copeland Oil Co. and drains the area downstream of Site 5. No significant problem was detected.

f. Site 8: The sample was taken at the culvert inlet which is the outlet of a pond. The pond is near the intersection of Idaho Avenue and the road which crosses the golf course and receives runoff from part of the parking ramp adjacent to the runway. The average concentrations of iron and zinc were 2.3 mg/l and 80 µg/l. The iron concentration exceeded the EPA criterion for fresh water bodies, as did the concentration of ammonia (10.4 mg/l at a pH of 7.7). The BOD and COD were 12.7 mg/l and 40 mg/l, respectively.

g. Site 9: The sample was taken from the creek that flows through the hole 1 fairway, about 50 feet upstream of the point where it crosses the access road (the road west of the clubhouse at the bottom of the hill) and drains the same area as Site 8 as well as part of the golf course. The average concentration of zinc was 130 µg/l. The concentration of ammonia (9.1 mg/l at a pH of 7.9) exceeds the EPA criterion.

h. Site 10: The sample was taken at the dam which is about 20 feet upstream of the confluence of the two creeks east of the hole 3 tee. This site receives runoff from most of the industrial area of the base and part of the parking ramp adjacent to the runway. A large amount of methylene chloride was found (50,000 µg/l). The following materials (and maximum concentrations) were detected: benzene (180 µg/l) and toluene (41 µg/l). The average concentrations of iron, chromium, silver and zinc were 1.2 mg/l, 76 µg/l, 44 µg/l, and 180 µg/l, respectively. The iron concentration exceeded the EPA criterion for fresh water bodies, as did the concentration of ammonia (5.6 mg/l at a pH of 8.0).

i. Site 12: The sample was taken where the stream enters the culvert, which passes underneath the railroad tracks, about 15 feet east of the base boundary fence near curb inlet F-33 on Ohio Avenue East. The stream drains a residential area. The BOD and COD were 12.3 mg/l and 30 mg/l, respectively.

j. Site 14: The sample was taken from the stream about 50 feet upstream of where it enters the Saranac River. The stream crosses US 22 about 2600 feet west of the intersection of Arizona Avenue and US 22 and drains the area around the north end of the runway. No significant problem was detected.

k. Site 24: The sample was taken from the stream where it passes through grate T-104, which is near the control tower parking lot. The stream drains about half of the parking ramp adjacent to the runway. The COD was 49 mg/l. The concentration of total iron was 5.1 mg/l, exceeding the EPA criterion for fresh water bodies.

l. Site 28: The sample was taken from the pond crossed by the hole 7 fairway. This pond receives runoff from part of the golf course and an area off base. The sample was examined under a microscope and appeared normal.

m. Site 29: The sample was taken from the stream where it enters Lake Champlain. The stream drains Cliffhaven subdivision and a good part of the base. The COD was 12 mg/l.

n. Site 30: The sample was taken from the small stream which flows immediately west of the marina boat house. The stream emerges from the hill a short distance upstream of the sampling point. The COD was 68 mg/l, the highest of all surface water sample analyses.

2. Summary of Analyses

Table 7 gives a summary of maximum priority pollutant concentrations found in surface water samples. Pollutants not found at any of the sites (e.g., Cd) are not listed. NS indicates the parameter analysis was not performed. ND indicates the analysis was performed, but the contaminant concentration was below the detection limit of the analysis. An asterisk (*) next to a value indicates that problems were experienced with the analysis of one or more samples from that site, and that the value given excludes values reported by the contract lab as <50 µg/l. Analyses for materials listed in Table 7 were not performed on samples collected at Sites 4, 6, 12, 14, 24, 28, and 30. Other analysis results are recorded in Appendix B and are listed in order of assigned sampling site number. The pesticide analysis for Site 3 (EPA Method 608) showed levels below the detection limits of the 21 compounds in the scan.

D. Results by Chemical Parameter

Appendix B lists the parameter values and concentrations detected at the sites sampled (given in Appendix A). NS indicates the analysis was not performed. ND indicates the analysis was performed, but the contaminant concentration was below the detection limit of the analysis. A parameter is included in Appendix B only if it was detected in at least one sample from the sites listed. For instance, although several sites were tested for total cyanide (see Appendix A), it was not detected at any of the sites and, therefore, does not appear in Appendix B. If more than one sample was taken from a site, the concentration listed in Appendix B is the average concentration. Metals concentrations are given in µg/l. Other concentrations are given in mg/l, and pH values are given in pH units.

Organic compounds detected by EPA Methods 624 and 625 appear in Appendixes A and B, respectively. Only sites where contaminants were found in at least one sample are listed. The concentrations of volatile organics, and acid/base/neutral semivolatile compounds are given in µg/l. When applicable, high and low values are given along with average concentrations. Average concentrations reported in Appendix C do not include values reported by the contract lab as <50 µg/l.

TABLE 7

SUMMARY OF MAXIMUM DETECTED PRIORITY POLLUTANT CONCENTRATIONS IN SURFACE WATER

Parameter	Maximum Concentration Observed (µg/l)						
Site #:	1	2	3	8	9	10	29
Benzene	210	190	82*	NS	NS	180	ND*
Bis (2-ethylhexyl) Phthalate	NS	NS	12.3	NS	NS	NS	NS
Chromium	NS	NS	50	ND	ND	76	NS
Copper	NS	NS	ND	ND	ND	ND	NS
Di-N-Butyl Phthalate	NS	NS	24.5	NS	NS	NS	NS
Lead	NS	NS	ND	ND	ND	ND	NS
Methylene Chloride	11K	57K	7150*	NS	NS	50K	ND*
Naphthalene	NS	NS	ND	NS	NS	NS	NS
Nickel	NS	NS	ND	ND	ND	ND	NS
Phenols	NS	NS	ND	NS	NS	NS	NS
Silver	NS	NS	ND	ND	ND	44	NS
Toluene	44	40	19.5*	NS	NS	41	ND*
Zinc	NS	NS	196.7	80	130	180	NS

V. OBSERVATIONS AND CONCLUSIONS

Many of the wastewater analyses were done by a contract lab, and the results were not available during the survey. Consequently, some problems did not come to light until lab results were analyzed (i.e., methylene chloride found in the stream flowing through the golf course and the Cliffhaven subdivision). Further sampling that would have otherwise been done to help determine pollutant sources was not conducted.

A. Sanitary Sewer System

Plattsburgh AFB is classified as a significant industrial user, and a significant industrial user must obtain a Significant Industrial User Wastewater Discharge Permit as outlined in Article 6 of Local Law No. 1 of 1984. Raw sewage leaves the base and enters the city's sanitary sewer system at three points: Sites 15 and 19 and Manhole C.

Most of the 620,000 GPD of sewage leaving the base flows past Site 15. Bis(2-ethylhexyl) phthalate, phenol and zinc were found at this site. These materials have prescribed discharge limits. The following materials were also found at Site 15: benzene, toluene, naphthalene and copper. These materials have prescribed action levels which "if exceeded will result in reconsideration of Water Quality and Technology based limits".[4] (For a more complete list of the materials found at this site, see Appendixes B, C and D.) The City of Plattsburgh routinely samples base effluent at Site 15 and has found lead, silver, chromium, and di-n-butylphthalate (11 June 1986) in addition to the compounds found during this survey. Silver and di-n-butylphthalate were detected at Site 17, and lead was found at Site 18. Sites 17 and 18 are upstream of Site 15. These and other pollutants may have gone undetected at Site 15 during the survey due to dilution, because of short duration of concentration peaks that did not coincide with the composite sampler sampling cycle (metals and EPA Method 625), or because grab samples were taken when concentrations were low (EPA Method 624).

One of five samples taken at Site 18 exceeded the maximum methylene chloride concentration allowed at the base discharge. The measured concentration was 100,000 µg/l compared to the allowed concentration of 290 µg/l in the base discharge. In fact, methylene chloride was detected at only Sites 17 and 18. The wastewater at Site 17, the Building 2291 wet well, was very turbulent. Conditions are excellent for the stripping of volatile organics. This was evident from sensing the atmosphere in the wet well area. The fumes were so strong during the first sampling session that respirators were used by survey personnel, thereafter.

The flow of industrial waste in the sanitary sewer system is intermittent, as illustrated by the methylene chloride results. This means that grab samples collected may not always indicate the presence of materials flowing through the sewers. In addition, this means that the concentrations in the composite samples are significantly less than the peak concentrations, especially if the duration of the industrial waste discharge is short in comparison to the time period the composite sampler is not collecting water.

Site 19 drains part of the old base. Bis(2-ethylhexyl)phthalate, phenol, silver, zinc, toluene, copper, and cyanide were found. The presence of both silver and cyanide suggests that photo processing wastewater is being discharged, but after consulting with the base silver recovery officer and with personnel in the photo hobby lab, it seems that no silver should have been found on the old base. The organics may have resulted from small discharge of fuel or resins used for bonding plastic pipe or from one or more of the hobby shops on the old base.

Iron levels found in the sanitary system were consistently higher than 1.0 mg/l, the maximum concentration recommended by the EPA for fresh water bodies. This, however, should not be of concern since the majority of the iron will be removed at the waste treatment plant, the threshold inhibitory concentration of iron in aerobic treatment processes is 1000 mg/l, and all concentrations measured were more than two orders of magnitude below this level.

B. Storm Drainage and Surface Water Bodies

Samples analyses indicate that significant amounts of solvents and other organics are reaching the storm sewer system. The stream reaching Lake Champlain via the base golf course and the Cliffhaven subdivision of Plattsburgh is receiving slugs of wastewater having concentrations of methylene chloride and aromatics in ranges typical of paint stripping wastewater. Significant concentrations of oils and grease (as high as 30 mg/l), chromium (50 µg/l), and zinc (as high as 380 µg/l) also suggest that industrial wastewater is being discharged to the storm drainage system. This is of particular concern because methylene chloride is a suspected carcinogen and is volatile. Benzene and hexavalent chromium are known carcinogens, and there is public access to the stream.

The microscopic analysis of golf course pond water was prompted by a floating scum which was suspected of being paint residue. The presence of solvents in the water supports the suspicion, but microscopic inspection of the water revealed only naturally occurring microorganisms and no trace of paint chip fragments or other paint residue.

The stream flowing through Cliffhaven (Sites 3 and 10) was not the only stream found to have excessively high concentrations of methylene chloride, benzene, and toluene. Samples taken at Sites 1 and 2 from streams draining a portion of the weapons storage area and the bulk storage area, respectively, had comparable levels. Sites 1 and 2 are on opposite ends of the base. This indicates that the use of solvents and subsequent discharge to the storm drainage system is widespread.

Two parameters that indicate potential problems with wastewater discharge are the biochemical oxygen demand (BOD) and the chemical oxygen demand (COD). BOD_5 analyses require a 5-day incubation period. Because some problems were experienced with the initial BOD analyses done on the survey, the BOD_5 analysis results reported in Appendix B represent one day of 24-hour composite sampling. The corresponding COD analyses represent the average of five days of 24-hour composite sampling. The ratio of the BOD_5 to the COD assumes values between 0.0 and 1.0, but it is usually found to be substantially less than 1.0 due to the short 5-day incubation period provided in the BOD test. For most naturally occurring organics (including domestic sewage), this ratio is 0.5 or greater, indicating high biodegradability. Man-made organics not normally found in nature (including chlorinated organics) are not as biodegradable, and their presence in a water sample decreases the BOD_5/COD ratio. An inspection of the BOD_5 and COD data presented in Appendix B also suggests that industrial waste is being discharged into the sanitary sewer system. Values of the BOD_5/COD ratio were in the 0.25 to 0.40 range for all samples having data for both analyses except for samples from Sites 6 and 20 which had values of approximately 0.1.

Samples from Site 6 are representative of the water flowing into Lake Champlain from the Copeland Oil property adjacent to Plattsburgh AFB. Samples from Site 5 are representative of the water as it crosses the boundary, leaving Plattsburgh AFB and entering the Copeland Oil property. A comparison of the BOD_5/COD ratios for Sites 5 and 6 highlights the change in the wastewater characteristics as it flows through the Copeland Oil property. The values of the ratios are 0.32 and 0.11, respectively. The BOD_5 of the water remains approximately the same as it flows through the Copeland Oil property while the COD nearly triples. This suggests that organics which are not readily biodegradable are being discharged into the stream as it flows through Copeland Oil property.

Another ratio that can be useful in assessing the nature of materials contributing to the COD of a wastewater is the COD/TOC ratio. Domestic sewage and most streams in which organics are responsible for high wastewater COD exhibit values between three and four for tha ratio. Streams having a high concentration of a nonorganic material which exert an oxygen demand (e.g., ammonia, ferrous iron) will have higher values, while streams having high concentrations of highly oxidized organic compounds (e.g., highly chlorinated organics) will have lower values. The values reported below were obtained by dividing averaged COD data by single sample TOC data. The values of the COD/TOC ratio found in the sanitary sewer system were 4.7, 65.0, 4.8, and 39.0 at Sites 15, 17, 18, and 19, respectively. The high values are consistent with high iron concentrations found at all four sites. However, the TOC values obtained for Sites 17 and 19 are uncharacteristically low, considering other analysis results from those sites. The COD values for these two sites, obtained for the same day and from the same composite sample as the sample sent for TOC analysis, were not significantly different from the average COD values. Therefore, the TOC analysis results for Sites 17 and 19 are suspected of being off by a factor of ten. The values of the COD/TOC ratio found in surface water bodies were 10.9, 4.0, 10.6, and 2.3 at Sites 3, 9, 10, and 14, respectively. The high values for Sites 3 and 10 are consistent with high iron concentrations found in samples from those sites. The low value for the COD/TOC ratio obtained for Site 14 is likely due to a low COD analysis result and the relative sensitivities of the two analytical methods at low concentration levels. This is supported by the value of the BOD_5/COD ratio for the site which was greater than 1.0.

It is possible that there are cross-connections between the sanitary and storm drainage systems. The corner of Connecticut Road and Idaho Avenue is an area where the two systems closely parallel each other and the density of manhole covers and curb inlets is high. Furthermore, it is the point where the area drained to Site 2 is closest to the area drained to Site 3. A relief sewer may have been installed or connected improperly accounting for the presence of priority pollutants at Sites 2, 3, and 10.

Ammonia concentrations in the golf course ponds and streams are high, probably from two major sources: degradation of urea used for deicing operations and fertilizer used on the golf course lawns. While the concentrations measured would probably not present a problem in winter when temperatures are low and threshold toxicity levels are high, concentrations were high enough during the survey to kill several fish species. Dilution of water leaving the base should reduce concentrations to acceptable levels in receiving rivers and streams, but this fact should be confirmed through sampling.

Urea degrades to form ammonia and carbon dioxide. The rate of urea degradation (and, therefore, ammonia production) is greatest when urea concentrations are highest. Because ammonia hydrolyzes readily and has a low volatility during winter, ammonia concentrations in the runoff from the melting ice and snow are very high. Residual deicing compound continues to degrade throughout the year, providing a source of ammonia to storm water runoff.

Ammonia is widely used in fertilizers to provide growing plants with nitrogen. It is introduced directly in some fertilizers (e.g., ammonium sulfate, ammonium nitrate), but some fertilizer formulations use urea and polymers of urea which release ammonia more slowly as the urea degrades. Ammonia is introduced into streams leaving the base from the golf course lawns from runoff.

The ammonia concentrations listed for Sites 3, 8, and 9 were obtained from composite samples obtained over the same 24-hour period. The sample at Site 10 was obtained during the following 24-hour period. The concentrations at Sites 3, 8, and 9 show samples taken upstream have higher ammonia levels, indicating that the major source of ammonia during the survey was the degradation of residual urea used for snow removal on the parking ramp where the runoff drains into the streams flowing through the golf course.

Surface water iron concentrations were 1.88 mg/l, 2.30 mg/l, and 1.20 mg/l at Sites 3, 8, and 10, respectively. Sites 8 and 10 are on separate branches which combine to flow off base at Site 3. As expected, the samples from Site 3 had concentrations between the concentrations at Sites 8 and 10. The concentration at Site 9 was also high (0.7 mg/l) but below the level recommended by the EPA for freshwater bodies. The concentration at Site 9 was expected to be of the same order as the concentration at Site 8 since it is immediately downstream from Site 8. However, sampling problems or variations in concentrations due to precipitation, uptake or changes in the composition of the storm water feeding into the stream could account for the lower level found. Dilution of the water leaving the base will probably reduce iron concentrations to acceptable levels, but fish living in water bodies on base are being exposed to iron concentrations above those recommended by the EPA for aquatic life.

Iron is commonly found in the divalent (ferrous) and trivalent (ferric) states, depending on the pH and oxidation potential of the surrounding environment. Ferric iron, dominant in oxidizing environments, generally has a lower solubility in water than does ferrous iron. The oxidation potential of the water is largely determined by the materials that are dissolved in it. Most organics are good reducing agents. There are exceptions, such as highly chlorinated organics, but most fuels, oils, and greases will serve to lower the oxidation potential of the water body into which they are discharged. Levels of oils and grease at Sites 3, 8, 9, and 10 were comparable to those found in the sanitary sewer system. If water having a low oxidation potential flows over or through soil which is rich in ferric iron, some of the iron will be reduced to the ferrous state and dissolved into the water. Subsequent changes in the oxidation potential of the water (e.g., due to biodegradation of organics, aeration of the stream, volatilization of organics) will cause the iron to change oxidation states, and may result in precipitation of ferric hydroxide which is characteristically rusty orange in color. The ferric hydroxide may settle out or it may remain suspended in the water as a pin floc, depending upon flow conditions.

The rusty orange color of iron in its oxidized state was observed in several of the ponds and streams in the golf course. Plattsburgh personnel informed us that an old scrap iron pile toward the southeast end of the runway had been covered over and might be the source of the iron. The iron concentration from samples taken at Site 24 (5.1 mg/l and the highest iron concentration found on the survey) confirms that the area is indeed a major source of iron, contributing to the high concentrations at Sites 8 and 3. However, there are other sources of iron as indicated by the concentrations found at Sites 25 and 10 (3.5 mg/l and 1.2 mg/l, respectively).

C. Combustible Gas Detection System

A combustible gas detection system could be installed in the sanitary sewer system to help alert personnel of forthcoming surges in organic levels in the sewers (e.g., due to fuel spills). However, any system that is installed will have shortcomings. The following is a partial list of considerations in the selection of a detection system:

1. A gas detection system rather than an organic liquid detection system is more appropriate for a solids-containing wastewater. Solids interfere with sensors' ability to detect organics by coating or blocking flow to sensors.

2. A combustible gas detection system can be more cost-effective as a warning system than on-line gas chromatographs, with regard to both capital investment and maintenance costs. A combustible gas sensor cannot identify the compound(s) present but can be used to indicate changes in gas composition.

3. Combustible gas detection systems are calibrated for a single compound (e.g., butane) or a gas of fixed composition. When the composition of the combustible gas does not vary, the gas detector will indicate gas concentration.

4. The composition of the organic portion of the gas reaching the sensor is a function of many factors including:

Composition of the wastewater
Volatility of organics in the wastewater
Wastewater flow rate
Degree of turbulence in the flow
Temperature
Distance from the wastewater-air interface to the sensor
Amount of air leakage entering the manhole

5. Sewer gas normally contains methane and other volatile organics which will produce a background level that may drift up or down with time. This means that the threshold alarm setting for other compounds will vary as well, because the sensor will respond to all combustible gases, but with different sensitivities.

6. Most combustible gas detection systems use diffusion-head sensors, relying on simple diffusion and natural convection for transport of the gas to the sensor. This results in a slower response to changes in composition, but also means much less maintenance than a forced-flow system. Of the many types of sensors available, catalytic-bead sensors cost more but operate at lower temperatures presenting less of a fire hazard. However, they are easily poisoned by compounds such as hydrogen sulfide and methylene chloride. Poison-resistant sensors are available which are more resistant to performance deterioration due to poisons, but frequent maintenance and recalibration are required.

7. Most sensors must be hard-wired into a central monitoring station. This means that the installation of such a system would be difficult and expensive at Plattsburgh, with thousands of feet of wire being required. However, a few manufacturers (e.g., Texas Analytical Controls) make sensors whose signals are sent by radiotelegraphy.

A list of names, addresses, and phone numbers of combustible gas detection equipment manufacturers, taken from the Pollution Equipment News Catalog and Buyer's Guide, is given in Appendix E.

VI. RECOMMENDATIONS

A. A combustible gas detection system should be installed to alert personnel at Plattsburgh AFB and at the POTW of organic spills reaching the sanitary sewer system. Poison-resistant catalytic sensors are essential for safe and effective performance. Transmission of radio signals from remote sensors to a central monitoring system is recommended. Diligent and frequent maintenance and calibration will be required if the system is to operate adequately. Explosion-proof housing should be provided for remote sensors. The cost per remote sensor installation is expected to be in excess of $3000. Therefore, sensors should be installed initially at only a few locations so that Plattsburgh AFB personnel can assess maintenance requirements, performance, and the overall value of such a detection system. Points in the system close to the potential sources and having highly turbulent flow should be selected for sensor installation. The size and weight of the sensing equipment and housing will determine whether it is practical to install the units directly in the sewer system at manhole locations or if the units will have to be installed at lift stations. If practical, the following manholes should be considered for sensor installation due to their locations. However, the final selection should be made by Plattsburgh personnel after inspecting flow conditions and assessing space requirements.

A-15, corner of Arizona Avenue and Idaho Avenue
D-3, NE corner of Building 2005
A-1, Building 2291
H-20, corner of New York Road and Idaho Avenue
H-11, New York Road by elementary school
204C, by tennis courts on old base.

B. A comprehensive hazardous waste survey should be conducted to determine the specific sources of the pollutants (e.g., methylene chloride) found in streams sampled during the July 1986 wastewater survey. An inspection of purchase order records should simplify the search.

C. Personnel entering the wet well area of Building 2291 should be required to use respirators. Water sampling at this site (Site 17) should be done by teams of two individuals, with only one entering the wet well. Warning signs should be posted to prevent personnel from entering the area without the proper safety equipment.

D. Alternatives for achieving better separation in oil/water separators should be investigated. Enhanced separation through pH adjustment alone does not appear to be effective or practical since pH values in the acidic range would be required, but acidification to break the detergent-oil emulsion, flow through a coalescing plate separator, then pH neutralization may provide improved separation for washrack effluents. Laboratory studies performed by a contract architectural and engineering firm with or without USAFOEHL assistance on actual wastewater are in order.

E. The possibility of cross-connections between the sanitary and storm sewer systems should be either confirmed or dispelled by Plattsburgh personnel through inspections and tracer studies. If cross-connections are confirmed, they should be eliminated.

F. The discharge point of all oil/water separators should be determined to assure that the discharge of the aqueous phase is connected to the sanitary sewer system, and not the storm drainage system. Elimination of organic-laden wastewater in the storm drains should have a favorable impact on the golf course stream and pond water quality.

G. Ammonia concentrations should be monitored in golf course streams and ponds and in the water courses receiving these flows. This is especially important when the ammonia burden in the water is highest (winter), and when threshold toxicity levels are lowest (summer). Fertilizer formulations used on the golf course lawns should be reviewed. The use of time-release formulations should be considered, and direct application of ammonia (e.g., in the form of ammonium sulfate) should be closely monitored if its use is necessary.

H. A sampling program should be established to monitor the BOD_5/COD ratios of water leaving Plattsburgh AFB and flowing through Copeland Oil property, since Copeland seems to be contributing significantly to the pollution load of the creek. Sampling Sites 5 and 6 are suitable as monitoring stations. It is important to compile data over a long period of time to establish discharge patterns from the Copeland Oil property and generate a data base for future reference.

I. Additional analyses should be conducted on the seepage from the marina beach area. The COD in the sample collected from this site was the highest of all surface water samples analyzed. The following analyses should be performed on three or four samples, collected weekly, to establish the characteristics of this stream: Oils and grease, phenols, BOD_5, COD. Because the stream flows into an area used for swimming, it is important to have some idea of what organics are responsible for such a high COD.

J. A hazardous waste training program should be instituted to educate personnel operating the shops on base as to where the shop drains and oil/water separators are connected, the proper classification (hazardous waste) and disposal of shop chemicals and the consequences when proper disposal procedures are not followed.

REFERENCES

1. Common Council of the City of Plattsburgh, NY, Local Law No. 1 of 1984, 3 May 1984

2. The Bureau of National Affairs, New York Water Classifications and Quality Standards, Washington DC, pp 861:1001-861:1001, (Sept 79)

3. USEPA, Quality Criteria for Water, Washington DC (July 1976)

4. McCullough, Marc, USAF Hosp/SGPB, Plattsburgh AFB, telephone conversation, November 1986

5. New York State Department of Environmental Conservation, "State Pollutant Discharge Elimination System (SPDES) Discharge Permit, 1 July 1981

APPENDIX A

SITE/ANALYSIS SUMMARY

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SITE/ANALYSIS SUMMARY

Site Number* Parameter	1	2	3	4	5	6	8	9	10	12	13	14	15	16
Biochemical Oxygen Demand	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Chemical Oxygen Demand	X	X	X	X	X	X	X	X	X	X	X	X	X	X
pH	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Temperature	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Oils and Grease	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Phenols (EPA 604)			X										X	
Pesticides (EPA 608)			X										X	
Volatile Organics (EPA 624)	X	X	X						X				X	
Acid/Base/Neutrals (EPA 625)			X										X	
Total Organic Carbon			X					X	X			X	X	
ICP Metals			X				X	X	X				X	
Iron			X				X	X	X				X	
Total Cyanide			X										X	
Nitrate-Nitrite			X				X	X	X			X		
Ammonia			X				X	X	X			X		
Kjeldahl Nitrogen			X				X	X	X			X		
Total Phosphorous			X				X	X	X					
Total Suspended Solids(TSS)	X	X	X	X	X	X	X	X	X	X	X	X	X	
Microscopic Analysis														
Sulfate													X	
Sulfide													X	
Surfactants													X	

* Sites 7 and 11 were not sampled due to lack of flow.
# Includes one or more of the following: antimony, arsenic, barium, beryllium, boron, cadmium, total chromium, hexavalent chromium, copper, lead, mercury, nickel, selenium, silver, thallium and zinc.

Site Number Parameter	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
BOD_5	X	X	X	X											
COD	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
pH	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Temp C	X	X	X	X	X	X	X	X	X		X	X	X	X	
Oil/Grease	X	X	X	X			X								
EPA Method 604	X	X	X												
EPA Method 608	X	X	X												
EPA Method 624	X	X	X				X				X		X		X
EPA Method 625	X	X	X												
TOC	X	X	X												
ICP Metals	X	X	X				X								
Iron	X	X	X					X	X						
Total Cyanide	X	X	X												
Nitrate/Nitrite															
Ammonia															
Kjeldahl Nitrogen															
Total Phosphorous															
TSS	X	X	X	X			X						X	X	
Microscopic Analysis												X			
Sulfate	X	X													
Sulfide	X	X													
Surfactants	X	X													

Includes one or more of the following: antimony, arsenic, barium, beryllium, boron, cadmium, total chromium, hexavalent chromium, copper, lead, mercury, nickel, selenium, silver, thallium and zinc.

APPENDIX B

PHYSICAL PARAMETER AND INORGANIC ANALYSIS RESULTS

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PHYSICAL PARAMETER AND INORGANIC ANALYSIS RESULTS

Site Number* Parameter	1	2	3	4	5	6	8	9
Biochemical Oxygen Demand (5-day) (mg/l)	5.1	12.7	14.8	3.3	8.0	7.5	12.7	6.5
Chemical Oxygen Demand (mg/l)	15	27	38	15	25	70	40	15
pH (pH units)	8.1	8.0	7.7	7.8	7.3	8.0	7.7	7.9
Temperature (°C)	24.3	24.1	20.9	24.5	15.0	16.0	24.6	24.7
Oils and Grease (mg/l)	ND	0.7	10.4	0.7	0.6	0.9	ND	0.6
Total Organic Carbon (mg/l)	NS	NS	3.5	NS	NS	NS	NS	3.7
Chromium (μg/l)	NS	NS	50	NS	NS	NS	ND	ND
Copper (μg/l)	NS	NS	ND	NS	NS	NS	ND	NS
Lead (μg/l)	NS	NS	ND	NS	NS	NS	ND	ND
Nickel (μg/l)	NS	NS	ND	NS	NS	NS	ND	ND
Silver (μg/l)	NS	NS	ND	NS	NS	NS	ND	ND
Zinc (μg/l)	NS	NS	196.7	NS	NS	NS	80	130
Iron (μg/l)	NS	NS	1880	NS	NS	NS	2300	700
Total Cyanide (mg/l)	NS	NS	ND	NS	NS	NS	NS	NS
Nitrate (mg/l)	NS	NS	3.9	NS	NS	NS	4.9	4.2
Nitrite (mg/l)	NS	NS	0.3	NS	NS	NS	0.2	0.5
Ammonia (mg/l)	NS	NS	5.6	NS	NS	NS	10.4	9.1
Kjeldahl Nitrogen (mg/l)	NS	NS	5.2	NS	NS	NS	12.9	11.0
Total Phosphorous (mg/l)	NS	NS	ND	NS	NS	NS	ND	ND
Sulfate (mg/l)	NS	NS	NS	NS	NS	NS	NS	NS
Sulfide (mg/l)	NS	NS	NS	NS	NS	NS	NS	NS
Surfactants, MBAS, (mg/l)	NS	NS	NS	NS	NS	NS	NS	NS
Total Suspended Solids (mg/l)	15	33	28.8	31	18	12	29	18

*Sites 7 and 11 were not sampled due to lack of flow.

Site Number Parameter	10	12	13	14	15	16
BOD_5	9.1	12.3	11.5	3.8	NS	134
COD	38	30	38	10	302.5	325
pH	8.0	7.2	7.7	8.0	7.4	7.2
Temp°C	21.9	24.5	24.7	17	22.5	23.3
Oil and Grease	ND	ND	ND	ND	29.3	16.7
TOC	3.6	NS	NS	4.4	64.6	NS
Chromium	76	NS	NS	NS	ND	NS
Copper	ND	NS	NS	NS	211.5	NS
Lead	ND	NS	NS	NS	ND	NS
Nickel	ND	NS	NS	NS	ND	NS
Silver	44	NS	NS	NS	ND	NS
Zinc	180	NS	NS	NS	116.7	NS
Iron (total)	1200	NS	NS	NS	1975	NS
Total Cyanide	NS	NS	NS	NS	ND	NS
Nitrate	4.4	NS	NS	0.2	NS	NS
Nitrite	0.2	NS	NS	ND	NS	NS
Ammonia	5.6	NS	NS	ND	NS	NS
Kjeldahl Nitrogen	7.7	NS	NS	0.9	NS	NS
Total Phosphorous	ND	NS	NS	NS	NS	NS
Sulfate	NS	NS	NS	NS	18.3	NS
Sulfide	NS	NS	NS	NS	2.3	NS
Surfactant	NS	NS	NS	NS	NS	NS
Total Suspended Solids	9	75	47	2		120.8
172.3						

Site Number Parameter	17	18	19	20	21	22	23
Biochemical Oxygen Demand	132.5	92.4	202.5	21.2	NS	NS	NS
Chemical Oxygen Demand	331.7	256.7	410	200	1960	275	NS
pH	7.1	7.2	7.3	7.5	5.9	7.4	7.3
Oils and Grease	42.2	16.1	33.8	18.8	NS	NS	9.9
Total Organic Carbon	5.1	53.6	10.5	NS	NS	NS	NS
Chromium	ND	ND	ND	NS	ND	ND	ND
Copper	153	170	149.8	NS	NS	NS	NS
Lead	ND	42	ND	NS	NS	NS	211
Nickel	ND	87	ND	NS	NS	NS	NS
Silver	13	ND	12	NS	NS	NS	22
Zinc	108	138	127.5	NS	NS	NS	NS
Iron (total)	2000	1560	1600	NS	NS	NS	NS
Total Cyanide	ND	ND	0.02	NS	NS	NS	NS
Nitrate	NS	NS	NS	NS	NS	NS	NS
Nitrite	NS	NS	NS	NS	NS	NS	NS
Ammonia	NS	NS	NS	NS	NS	NS	NS
Kjeldahl Nitrogen	NS	NS	NS	NS	NS	NS	NS
Total Phosphorous	NS	NS	NS	NS	NS	NS	NS
Sulfate	29	13.2	NS	NS	NS	NS	NS
Sulfide	1.5	2.0	NS	NS	NS	NS	NS
Surfactants	4.8	NS	NS	NS	NS	NS	NS
Suspended Solids	143	107.5	142.7	37	NS	NS	18

Site Number Parameter	24	25	26	27	28	29	30	31
BOD_5	NS	NS	NS	NS	NS	NS	NS	NS
COD	49	48	240	1260	NS	12	68	NS
pH	7.5	7.8	8.2	9.0	8.7	7.7	9.0	NS
Temp°C	15	20	NS	22	23	19	22	NS
Oil and Grease	NS	NS	NS	NS	NS	NS	0.8	NS
TOC	NS	NS	NS	NS	NS	NS	NS	NS
Chromium	NS	NS	NS	NS	NS	NS	NS	NS
Copper	NS	NS	NS	NS	NS	NS	NS	NS
Lead	NS	NS	NS	NS	NS	NS	NS	NS
Nickel	NS	NS	NS	NS	NS	NS	NS	NS
Silver	NS	NS	NS	NS	NS	NS	NS	NS
Zinc	NS	NS	NS	NS	NS	NS	NS	NS
Iron (total)	5100	3500	NS	NS	NS	NS	NS	NS
Total Cyanide	NS	NS	NS	NS	NS	NS	NS	NS
Nitrates	NS	NS	NS	NS	NS	NS	NS	NS
Nitrites	NS	NS	NS	NS	NS	NS	NS	NS
Ammonia	NS	NS	NS	NS	NS	NS	NS	NS
Kjehldal Nitrogen	NS	NS	NS	NS	NS	NS	NS	NS
Total Phosphorous	NS	NS	NS	NS	NS	NS	NS	NS
Sulfates	NS	NS	NS	NS	NS	NS	NS	NS
Sulfides	NS	NS	NS	NS	NS	NS	NS	NS
Surfactants	NS	NS	NS	NS	NS	NS	NS	NS
Total Suspended Solids	NS	NS	NS	NS	NS	NS	NS	NS

APPENDIX C

VOLATILE ORGANICS ANALYSIS RESULTS
(EPA Method 624)

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VOLATILE ORGANICS ANALYSIS RESULTS
(EPA Method 624)

Site #	Compound	Total # Analyzed	# of Samples Averaged	Concentrations (μg/l) High	Low	Average* of Detected Values
	Methylene Chloride					
1		1	1			11000
2		1	1			57000
3		4	2	12000	2300	7150
10		1	1			50000
17		5	1			12
18		5	1			100000
	Trichlorofluoromethane					
19		5	1			55
	Chloroform					
17		5	1			12
18		5	2	20	11	15.5
	Benzene					
1		1	1			210
2		1	1			190
3		4	2	140	24	82
10		1	1			180
15		4	1			82
18		5	1			200
	Toluene					
1		1	1			44
2		1	1			40
3		4	2	28	11	19.5
10		1	1			41
15		4	1			14
17		5	2	24	5.5	14.8
18		5	1			38
19		5	1			6.1
	1,2-Dichlorobenzene					
15		4	2	73	22	47.5
18		4	3	150	25	105

* Excluding values that are below the detection limit, and values that were reported as < 50 μg/l by contract laboratory.

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APPENDIX D

ACID/BASE/NEUTRAL SEMIVOLATILE COMPOUNDS
(EPA Method 625)

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ACID/BASE/NEUTRAL SEMIVOLATILE COMPOUNDS
(EPA Method 625)

Site #	Compound	Total # Analyzed	# of Samples Averaged	Concentrations (µg/l) High	Low	Average* of Detected Values
	1,2,4-Trichlorobenzene					
3		5	1			14
15		4	1			18
	Naphthalene					
15		4	2	17	13	15
17		5	2	38	7.4	22.7
	4-Chloroaniline					
15		4	2	13	12	12.5
17		4	1			24
	Hexachlorobutadiene					
17		5	1			30
	2-Methylnaphthalene					
15		4	2	14	12	13
17		5	2	26	13	19.5
	Diethyl Phthalate					
19		4	2	26	16	21
	Di-N-Butyl Phthalate					
3		5	2	27	22	24.5
17		5	2	31	23	27
19		4	1			24
	Butyl Benzyl Phthalate					
18		4	1			30
	Bis (2-Ethylhexyl) Phthalate					
3		5	4	13	12	12.3
15		4	1			19
17		5	2	64	23	43.5
18		4	2	20	14	17
19		4	2	19	14	16.5
	Phenol					
15		4	1			14
17		5	1			32
18		4	1			16
19		4	2	51	14	32.5

Site #	Compound	Total # Analyzed	# of Samples Averaged	Concentrations (μg/l) High	Low	Average * of Detected Values
	4-Methylphenol					
15		4	4	100	55	75
17		5	5	160	11	82.4
18		4	1			92
19		4	3	216	20	92.3
	2-Nitrophenol					
15		4	1			11
19		4	2	30	19	24.5
	Chlorotoluene					
3		5	1			1.9
15		4	4	40	4.9	15.7
17		5	5	9000	6.1	2412.8
18		5	4	8.2	1.1	3.7
19		4	2	20	5.6	12.8

APPENDIX E

COMBUSTIBLE GAS DETECTION EQUIPMENT MANUFACTURERS

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COMBUSTIBLE GAS DETECTION EQUIPMENT MANUFACTURERS

American Gas & Chemical Co. Ltd.
220 Pegasus Ave.
Northvale NJ 07647
(201) 767-7300

Corrpro Company Inc.
Box 1179
Medina OH 44258
(216) 723-5082

Datatest Inc.
6850 Hibbs Lane
Levittown PA 19057
(215) 943-0668

Delphi Instruments
3030 Red Hat Lane
Whittier CA 90601
(213) 692-9021.

Despatch Industries, Inc.
Box 1320
Minneapolis MN 55440
(612) 331-1873

Detektor Division Semetex
3450 Fujita St.
Torrance CA 90505
(213) 539-0407

Dynamation, Inc.
168 Enterprise Dr.
Ann Arbor MI 48103
(313) 769-0573

Energetics Science Division of
National Draeger
6 Skyline Dr.
Hawthorne NY 10532
(914) 592-3010

Enmet Corporation
2308 S. Industrial
Ann Arbor MI 48104
(313) 761-1270

Environmental Tectonics Corporation
County Line Industrial Park
Southampton PA 18966
(215) 355-9100 or (800) 523-6079

Erdco Engineering Corporation
Box 1310
Evanston IL 60204
(312) 328-0550

Gastech, Inc.
331 Fairchild Dr.
Mountain View CA 94043
(415) 967-6794

Griffin Technics, Inc.
Box 330 178, Rt. 46
Lodi NJ 07644
(201) 778-2131

HNU
160 Charlemont St.
Newton MA 02161
(617) 964-6690

Heath Consultants, Inc.
100 Tosca Dr, Box CS-200
Stoughton MA 02072
(617) 344-1400

I T T Barton
900 S. Turnbull Canyon Rd.
City of Industry CA 91749
(818) 961-2547

Intek Corporation
Box 42821 606
Houston TX 77042
(713) 498-5855

Leeds & Northrup Instruments
Sumneytown Pike
North Wales PA 19454
(215) 643-2000

MSA
600 Penn Center Blvd.
Pittsburgh PA 15235
(800) MSA-2222 or (412) 273-5000

M. C. Products Division of Material
Control
7720 E. Redfield Rd., Suite # 2
Scottsdale AZ 85260
(602) 998-9577

Matheson Gas Products, Inc.
30 Seaview Dr., Box 1587
Secaucus NJ 07094
(201) 867-4100

Monitronics, Inc.
Box 247
Eagle PA 19480
(215) 458-5133

National Draeger, Inc.
Box 120
Pittsburgh PA 15230
(415) 787-8383

Neotronics N. A., Inc.
Box 370
Gainesville GA 30503
(404) 535-0600

Quantum Instruments, Inc.
1075 Stewart Ave.
Garden City NY 11530
(516) 222-0611

Rexnord Electronic Products
45 Great Valley Corp. Center
Malvern PA 19355
(215) 647-7200

Rexnord Gas Detection Products
207 E. Java Dr.
Sunnyvale CA 94089
(408) 734-1221

Scott Aviation
225 Erie St.
Lancaster NY 14086
(716) 683-5100

Sensidyne Inc.
12345 Starkey R., Suite E
Largo FL 33563
(813) 530-3602

Sieger Gasalarm
4931B S Mingo
Tulsa OK 74146
(918) 663-2354

Sierra Monitor Corporation
1050-K E. Duane Ave.
Sunnyvale CA 94086
(408) 746-0188

Sybron Analytical Products Division
221 Rivermoor St.
Boston MA 02132
(617) 469-3000

Teledyne Analytical Instruments
16830 Chestnut
La Puente CA 91748
(818) 961-9221

Texas Analytical Controls, Inc.
4434 Bluebonnet Dr.
Stafford Tx 77477
(713) 240-4160

Xontech, Inc.
6862 Hayvenhurst Ave.
Van Nuys CA 91406
(818) 787-7380

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OL AD, USAFOEHL APO San Francisco 96274-5000	1
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